

# The Regional Transport of Ozone

## *New EPA Rulemaking on Nitrogen Oxide Emissions*



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*EPA tracks emissions of six principal air pollutants - carbon monoxide, lead, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds. All have decreased significantly since passage of the Clean Air Act in 1970 - EXCEPT FOR NITROGEN OXIDES.*

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## Facts About NO<sub>x</sub> Emissions

Emissions of nitrogen oxides (NO<sub>x</sub>) discharged into the atmosphere can pose significant adverse effects on human health and the environment. In an effort to limit these adverse impacts, the U.S. Environmental Protection Agency (EPA) issued

a new regulation in September 1998 specifically aimed at reducing NO<sub>x</sub> emissions.

Nitrogen oxides are a class of compounds made of nitrogen and oxygen in varying percentages. Nitrogen dioxide, one of six pollutants tracked nationally, is included in the family of nitrogen oxides. NO<sub>x</sub> are emitted from high temperature combustion processes. Sources include motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. In 1997, over 23 million tons of nitrogen

oxides were emitted into the

air in the United States. An important characteristic of NO<sub>x</sub> emissions is that they can be transported long distances and cause problems far from the original emissions source.

### Clean Air Act

The Clean Air Act provides EPA and states with the responsibility to address air pollution from a variety of sources. EPA has established National Ambient Air Quality Standards for six pollutants to provide protection against harmful levels that could impact public health and the environment. These pollutants are often referred to as the six "criteria" pollutants, and include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The pollutant ozone is not emitted directly into the air but is formed when NO<sub>x</sub> and volatile organic compounds (VOC) react in the presence of sunlight. Ozone occurs at ground-level and can cause serious human health and environmental problems. This new regional NO<sub>x</sub> transport rule is an important component of EPA's ozone reduction program.

## New Regional NO<sub>x</sub> Transport Rule

The Clean Air Act (Section 110) provides that each State Implementation Plan (SIP) must contain provisions preventing sources within the state from "contributing significantly to nonattainment problems or interfering with maintenance" in downwind states. In other words, this provision addresses the transport problems associated with ozone and pollutants such as NO<sub>x</sub> that form ozone.

The Ozone Transport Assessment Group (OTAG), a collection of the 37 eastern-most states and the District of Columbia, along with industry representatives and environmental groups, worked with EPA over a 2-year period to study the ozone transport problem. The recommendations from OTAG's work form the basis of EPA's new regional NO<sub>x</sub> transport rule, signed in September 1998. The OTAG recommendations focus on achieving additional reductions of NO<sub>x</sub>, in order to meet the National Ambient Air Quality Standards for ozone. The OTAG recommendations do not identify measures for VOC, although it is understood that some states may also need to reduce VOC to achieve the ozone standards.

## Affected States

The rule requires 22 states — Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, Missouri, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Wisconsin, and West Virginia, plus the District of Columbia — to prepare new plans for reducing NO<sub>x</sub> emissions.



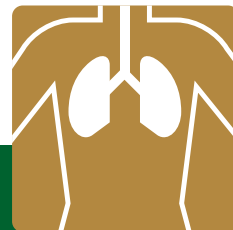
### Ozone (smog)

- NO<sub>x</sub> contributes to the formation of ground-level ozone.
- Ground-level ozone occurs at high levels during the summertime.
- Ozone can cause serious respiratory problems, particularly in sensitive populations, such as children and people with chronic lung conditions.
- People who work or exercise outside for long periods during the day are also susceptible to respiratory problems from ozone.
- Ozone damages vegetation and reduces crop yields.



### Acid Rain

- NO<sub>x</sub> and sulfur dioxide react with other substances to form acids which fall to the earth as rain, snow, fog or dry particles.
- Acids can be carried by the wind for hundreds of miles.
- Acid rain damages forests, causes deterioration of cars, buildings, and historical monuments.
- Acid rain causes lakes and streams to become acidic and unsuitable for many fish.



### Particles

- NO<sub>x</sub> reacts with ammonia, moisture, and other compounds to form nitric acid vapors and nitrate particles.
- Human health concerns include effects on breathing, damage to lung tissue, and premature death.
- Small particles penetrate deeply into sensitive parts of the lungs and cause or worsen respiratory disease, such as emphysema and bronchitis, and aggravate heart disease.

## Environmental and Health Impacts of NO<sub>x</sub>

Because NO<sub>x</sub> includes a number of different compounds, the environmental and health effects are many and diverse:



The new NO<sub>x</sub> rule will require 22 states and the District of Columbia to prepare State Implementation Plans aimed at reducing NO<sub>x</sub> emissions.

The overall purpose of the rule is to reduce regional transport of NO<sub>x</sub> that contributes to ozone nonattainment in multiple eastern states, not to reduce emissions from a specific source in a particular state.

The rule does not prescribe how states should reduce emissions to meet their NO<sub>x</sub> budget. Instead it allows states the flexibility to develop customized plans that will most effectively and cost-efficiently help them meet their reduction goals. Electric utilities are likely to be one of the major sources targeted for reductions. OTAG identified utilities as a major source for achieving significant NO<sub>x</sub> reductions, and EPA's analysis agrees with OTAG's recommendations. Emission reductions from utilities and other large boilers would be more cost effective in terms of dollars spent per ton of NO<sub>x</sub> reduced, particularly when compared to sources that have already reduced emissions substantially.

## Rule Provisions

The rule assigns a summertime NO<sub>x</sub> emissions limit or budget for each affected state. EPA established the limits by determining the amount of NO<sub>x</sub> emissions that would remain in each state

## Market-based Emissions Trading Program

As part of developing a cost-effective strategy, EPA developed a model market-based emissions trading program that states may use in controlling NO<sub>x</sub> emissions.

This is a proven, cost-effective technique for achieving overall emissions reductions while providing flexibility to affected sources. The program allows sources that exceed their emissions reduction requirements, or that achieve the required reductions ahead of schedule, to sell

"credits" to other sources that cannot meet their limits. This type of program already is being successfully implemented for sulfur dioxide emissions in EPA's Acid Rain Program.

### Timeline for complying with Regional NO<sub>x</sub> Transport Rule

September 1999 - 22 affected states, plus DC, submit plans to EPA

May 2003 - States put NO<sub>x</sub> controls in place

September 2007 - States meet overall NO<sub>x</sub> budgets

after reasonable, cost-effective control measures were applied. States are required to have controls in place on larger industrial sources by May 2003. Along with these controls and other necessary measures including mobile source controls, states must meet their overall NO<sub>x</sub> budgets by September 2007.



### Water Quality Deterioration

- Increased nitrogen loadings in water bodies, particularly coastal estuaries, upset the chemical balance of nutrients used by aquatic plants and animals.
- Additional nitrogen accelerates eutrophication, which leads to oxygen depletion, and reduces fish and shellfish populations.



### Global Warming

- One member of the NO<sub>x</sub> family, nitrous oxide, is a greenhouse gas.
- It accumulates in the atmosphere with other greenhouse gases causing a gradual rise in the earth's temperature.
- This will lead to increased risks to human health, a rise in the sea level, and other adverse changes to plant and animal habitat.



### Toxic Chemicals

- NO<sub>x</sub> reacts in the air readily with other common organic chemicals, and even ozone, to form a wide variety of toxic chemicals.
- Some of these toxic products may cause biological mutations.
- Examples include the nitrate radical, nitroarenes, and nitrosamines.



### Visibility Impairment

- Nitrate particles and nitrogen dioxide can block the transmission of light.
- Visibility impairment occurs in urban areas and on a regional scale in our national parks.

## New Transitional Classification

In 1997, EPA issued a new standard based on 8-hour concentrations of ozone. EPA will designate areas as “nonattainment” for the 8-hour standard in year 2000. This NO<sub>x</sub> transport rule is expected to help areas comply with EPA’s new 8-hour national air quality standard for ozone. Areas that would normally be classified as “nonattainment” for the 8-hour standard, but that eventually achieve attainment with the 8-hour standard as a result of complying with the new regional NO<sub>x</sub> transport rule, will be eligible for classification as “transitional.” This means that no or minimal additional local emission reductions will be required, effectively reducing the burden and cost associated with local controls. States must submit implementation plans in 1999 and 2000 that include control measures necessary to achieve the emissions reductions required by the new NO<sub>x</sub> rule. In addition, to qualify

### Ozone Transitional Areas Schedule (Affected by NO<sub>x</sub> Transport Rule)

September 1999 and May 2000 - States submit plans to EPA

July 2000 - EPA designates areas as transitional for 8-hour ozone standards

May 2003 - States put additional controls in place

September 2007 - States meet overall NO<sub>x</sub> budgets

for the transitional classification, EPA will determine if the area has air quality meeting the 0.12 ppm 1-hour ozone standard by year 2000. This transitional classification will allow areas to use the benefits of the new NO<sub>x</sub> transport rule. This rule helps states achieve the 8-hour ozone standard earlier than required by the Clean Air Act without having to use costly local controls.

## State Petitions

The Clean Air Act (Section 126) allows downwind states to file petitions with EPA, requesting EPA to take action to reduce emissions from industrial sources in upwind states that contribute significantly to nonattainment in the petitioning states. In 1997, 8 northeastern states filed petitions identifying sources of NO<sub>x</sub> in 22 states and the District of Columbia that

are subject to the new NO<sub>x</sub> rule, plus a few other states. EPA will take action in response to these petitions which will be dependent in part on how states address emission reduction requirements in the NO<sub>x</sub> transport rule.

## Impacts

EPA anticipates that full implementation of the NO<sub>x</sub> transport rule will reduce total emissions of NO<sub>x</sub> by an average of 28% in the affected states and the District of Columbia. This rule will remove about 1.2 million tons of NO<sub>x</sub> from the air. This is roughly equivalent to getting 166 million cars off the road.

With regard to attainment status for the new 8-hour ozone standard, implementation of the regional NO<sub>x</sub> reduction program is expected to bring a majority of the new nonattainment areas into attainment. Cost impacts depend on the controls put in place by the affected states and the District of Columbia. EPA analyses show that reducing one ton of NO<sub>x</sub> from electric utility plants costs about \$1500, significantly less per ton than implementing local controls (which range as high as \$9500/ton). EPA calculates that the costs of reducing utility emissions could cause residential electric rates to increase less than 2 percent. Utility restructuring during this same period, however, is expected to substantially cut residential electric rates 20-30 percent, thus making the 1 percent increase negligible.

## FOR MORE INFORMATION

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